$CO_2(v_2)$-O quenching rate coefficient derived from coincidental Fort Collins lidar and SABER measurements.

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Among the processes governing the energy balance in the mesosphere and lower thermosphere (MLT), the quenching of $CO_2(v_2)$ vibrational levels in collisions with oxygen atoms plays an important role. However, neither the rate coefficient of this process ($k(CO_2\text{-}O)$) nor the atomic oxygen concentrations ([O]) in the MLT are well known. The discrepancy between $k(CO_2\text{-}O)$ measured in the lab and retrieved from atmospheric measurements is of about factor of 2.5. At the same time, the discrepancy between [O] in the MLT measured by different instruments is of the same order of magnitude. In this work we used a synergy of a ground based lidar and satellite infrared radiometer to make a further step in understanding of the physics of the region.

In this study we apply the night- and daytime temperatures between 80 and 110 km measured by the Colorado State University narrow-band sodium (Na) lidar located at Fort Collins, Colorado for retrieving the product of $k(CO_2\text{-}O)$ x [O] from the limb radiances in the 15 μm channel measured by the SABER/TIMED instrument for nearly simultaneous common volume measurements of both instruments within ±1 degree in latitude, ±2 degrees in longitude and ±10 minutes in time. We derive $k(CO_2\text{-}O)$ and its possible variation range from the retrieved product by utilizing the [O] values measured by the SABER and other instruments.